Multilevel Ensemble Transform Particle Filtering

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This presentation extends the Multilevel Monte Carlo variance reduction technique to nonlinear filtering. In particular, Multilevel Monte Carlo is applied to a certain variant of the particle filter, the Ensemble Transform Particle Filter (ETPF). A key aspect is the use of optimal transport methods to re-establish correlation between coarse and fine ensembles after resampling; this controls the variance of the estimator. Numerical examples present a proof of concept of the effectiveness of the proposed method, demonstrating significant computational cost reductions (relative to the single-level ETPF counterpart) in the propagation of ensembles.